REMARKS

This amendment is responsive to the Office Action of July 3, 2003. Reconsideration of claims 1-17 and 23 is respectfully requested.

Claims 1-17 and 23 remain in the application. Claims 18-22 have been canceled.

The Office Action

Claims 1, 2, 9, and 10-11 stand rejected under 35 U.S.C. §102(e) as being anticipated by Tasaki, et al. (U.S. Patent No. 6,319,425).

Claims 3-7, 12-16 and 23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tasaki, et al., in view of Lowery (U.S. Patent No. 5,959,316)

The Claims Distinguish Over the References of Record

Claim 1 now calls for a light source including a light emitting component which emits light when a voltage is applied. The intensity of the light varies across the light emitting component at the applied voltage. A phosphor-containing material is positioned to receive light emitted by the light emitting component. The phosphor-containing material converts at least a portion of the light to light of a different wavelength. The phosphor-containing material has a thickness which varies **directly in proportion** to the intensity of the light emitted by the light emitting component at the applied voltage. The uniformity of color emission is improved as compared with a uniform thickness layer.

Tasaki, et al. discloses a removable cap **1, 20** for an LED **2**. The cap contains a fluorescent substance. There is no suggestion in Tasaki of providing a cap with a thickness which varies directly **in proportion** to an intensity of the light emitted by the light emitting component at an applied voltage. Takasi makes two chromaticity measurements, one forward, one to the side, and assumes that these represent the entire variation in light distribution. Takasi then varies the **concentration** of the fluorescent material in the side and forward of the device, not the thickness (see col. 4, lines 44-62).

The Examiner points to FIGURE 5 as being the solution to Takasi's recognition that chromaticity measurements differ from the side to the front. This is simple not the case, as evidenced by col. 5, lines 29-43. Rather, the shape of the cap of FIGURE 5 is designed as a light gathering mechanism to focus light on the forward direction. If the cap is shaped to act as a lens focusing the light, it cannot have been designed to accurately reflect proportional changes in light intensity, as the Examiner contends. Rather, as discussed above, Tasaki uses differences in concentration to account for the front to side change.

Even if an attempt were to be made to use a cap such as FIGURE 5 of Tasaki to correct variations by changing its thickness, rather than the concentration, it would not achieve the presently claimed proportionality. As demonstrated by the applicants own measurements, light variation is not simply high or low, as Tasaki's two measurements would suggest. Due to the presence of connectors and other features, the light emitted from an LED does not follow the curved profile of the Tasaki's cap of FIGURE 5. Rather, as illustrated in FIGURE 6 of the present application, peaks in light intensity are spaced by regions of no or little light output. The crude variations which could be achieved by making changes in the thickness of Tasaki's cap could thus not be **directly proportional** to the light output.

Further, Tasaki, et al. makes no suggestion as to how the presently claimed proportional variation could be achieved. Tasaki forms the cap separately from the LED and then positions the cap on the LED. It would be extremely difficult, if not impossible, to achieve a thickness which varies directly in proportion to an intensity of the light emitted by the light emitting component by the separate forming method of Tasaki, et al. Thus, by teaching that the cap should be formed separately and then attached to the LED, Tasaki teaches away from the present invention.

Accordingly, it is submitted that claim 1 and claims 2-9 dependent therefrom differ patentably and unobviously over the references of record.

Claim 10 has been amended and now recites a light source including a phosphor-containing material having a thickness which varies **directly in proportion** to

the light passing through the phosphor material at an applied voltage, the thickness being greater in regions where the intensity of the light emitted by the light emitting component is higher and lesser in regions where the intensity of the light emitted by the light emitting component is lower.

As discussed above, although **Tasaki's** cap may vary in thickness, it does not disclose varying the thickness **directly in proportion** to the intensity of the light. The presence of electrical connectors and so forth (see Fig. 3 of Tasaki) render the emission of light over the top surface of the LED non-uniform, not curved, peaking in the center as does Tasaki's cap. Tasaki does not recognize the problem nor provide a solution as to how such variations in intensity can be accommodated.

Accordingly, it is submitted that claim 10 and claims 11 and 16 dependent therefrom differ patentably and unobviously over the references of record.

Claim 12 recites a light source with a phosphor-containing material having a thickness which is greater in regions where the intensity of the light emitted by the light emitting component is higher and lesser in regions where the intensity of the light emitted by the light emitting component is lower. The phosphor-containing material is formed by forming a layer of a phosphor-containing light curable material over the light emitting component, energizing the light emitting component for a sufficient period of time to cure a portion of the curable material, and removing remaining uncured curable material.

The Examiner argues that claim 12, as a product by process claim, cannot be considered patentable absent an unobvious difference. Applicants have, in prior amendments, clearly annunciated the differences between the present invention and the prior art and the non-obviousness of these differences. The Examiner's attention is therefore drawn to the arguments previously presented.

As previously discussed, **Lowery** makes no suggestion of forming a coating by the claimed process. In Lowery, as in conventional devices, the UV curable coating is cured by an external UV source, not by UV emitted by the LED.

Moreover, the cap of **Tasaki** shown in Figure 5 is a mass produced device- a "one size fits all." Even if the cap of Figure 5 does account for some variations in the

light output, as the Examiner contends, it can do so in only a very gross way. Tasaki, for example, takes **two** chromaticity measurements, one on the side, and one forward of the LED. Even if assuming arguendo that the Examiner is correct in inferring that Takasi is using these measurements in shaping the cap (which applicants dispute, based on the specification at col. 5, lines 29-42, as discussed above) Tasaki must have falsely assumed that two measurements are sufficient to account for all the variations across a light emitting device. As applicants have found, this in no way represents the actual variations across an LED, due to the presence of connectors and other features which all contribute to changes in the light emitted. It could not be considered obvious for Tasaki to take a hundred or more chromaticity measurements on a single LED and craft a cap accordingly, due, in part, to the extreme difficulty and time consuming nature of such an exercise. Moreover, even if this were to be possible, the cap formed could only be used for the single LED for which the measurements are made. It could not be used as a one size fits all since every LED is different, due to variations in the manufacturing process. It would also need to be fitted with a degree of accuracy which would be beyond current processing techniques, due to the non uniform radial variations. Mass production would thus be impossible.

The present method provides a **unique coating** of varying thickness which is **highly specific** for the LED on which the coating is formed. This unique matching is not shown or suggested in the prior art. As a result, the changes in light intensity of every LED used by the present process can be **exactly** matched by the thickness of the coating. Consequently, the light output has a much more even distribution than could ever be achieved by a cap formed using the chromaticity measurements of Tasaki, and at a much lower cost, rendering the process amenable to mass production.

As a result of the present process, the use of highly expensive phosphor materials can be minimized by using exactly the right amount for conversion of UV rays, without risking the potential for harmful UV rays to pass from the light source if too thin a layer is used in some areas. Additionally, loss in lumen output, due to diffusion effects of the phosphor can be minimized. The cap of Tasaki could never achieve an exact match in

light emission, thus the cap would always need to be of a substantially greater thickness, in parts, than is strictly necessary.

This distinct improvement of the presently claimed lamp, both in cost savings and in reductions in the risks of releasing UV rays to the environment, are not obvious in view of the disclosure of Tasaki or Lowery, either taken alone or in combination.

Because the present light source produced by the claimed process is far superior to conventionally produced lamps and has a radial uniformity of color which has not been heretofore disclosed or suggested in the prior art, it is submitted that the prior art does not disclose or suggest a lamp which is functionally equivalent to the claimed light source.

Accordingly, it is submitted that claim 12 and claims 13-15 and 17 dependent therefrom differ patentably and unobviously over the references of record.

Claim 23 recites a light source with improved color distribution in which a phosphor containing layer is formed by a method which includes energizing the light emitting component for a sufficient period of time to cure a portion of the curable material and removing remaining uncured curable material.

The Examiner suggests that the lamp of Lowery and Tasaki, et al. is at least a functional equivalent of the presently claimed light source. Applicants respectfully traverse. The arguments presented, both in prior amendments and above, with respect to claim 12, clearly show, that the presently claimed lamp is far superior to any which could be achieved by the method of Tasaki or Lowery, alone or in combination, and that the improvements could not be considered obvious in view of the disclosures of these two references.

Because the present light source produced by the claimed process is far superior to conventionally produced lamps and has a radial uniformity of color which has not been heretofore disclosed or suggested in the prior art, it is submitted that the prior art does not disclose or suggest a lamp which is functionally equivalent to the claimed light source.

Accordingly, it is submitted that claim 23 distinguishes patentably and unobviously over the references of record.

CONCLUSION

For the reasons set forth above, it is submitted that claims 1-17 and 23 distinguish patentably and unobviously over the references of record. An early allowance of all claims is earnestly solicited.

Respectfully submitted,

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